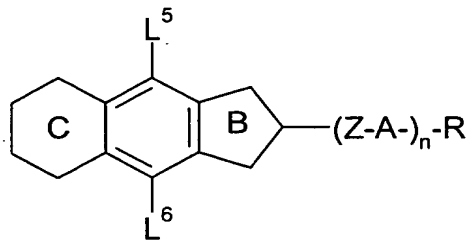
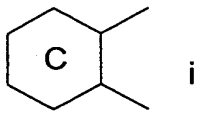
Patent Claims

1. Cyclopenta[b]naphthalene derivatives of the general formula (I)

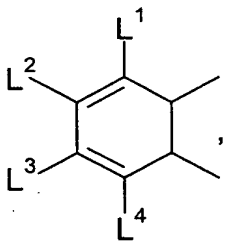


(I)

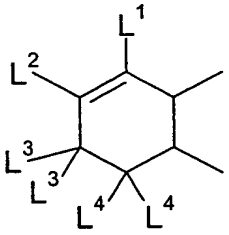
in which:



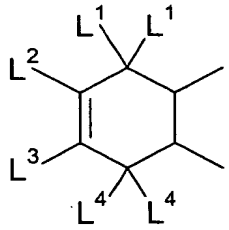
is



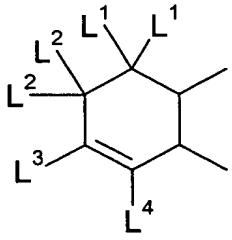
a,



b,

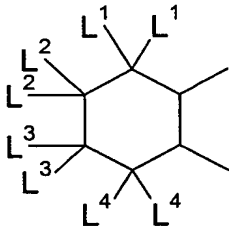


c,

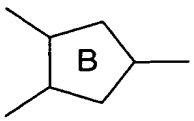


d

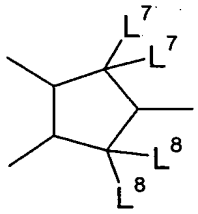
or



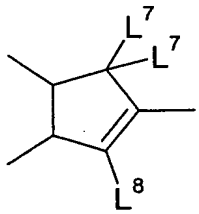
e



is



a,



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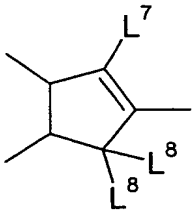
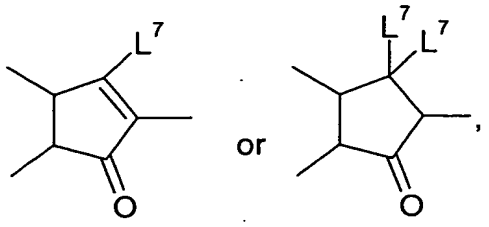


c



d e

Z is in each case, independently of one another, a single bond, a double bond, $-CF_2O-$, $-OCF_2-$, $-CH_2CH_2-$, $-CF_2CF_2-$, -C(O)O-, -OC(O)-, $-CH_2O-$, $-OCH_2-$, -CF=CH-, -CH=CF-, -CF=CF-, -CH=CH- or -C≡C-,

A is in each case, independently of one another, 1,4-phenylene, in which =CH- may be replaced once or twice by =N-, and which may be monosubstituted to tetrasubstituted, independently of one another, by halogen (-F, -Cl, -Br, -I), -CN, $-CH_3$, $-CH_2F$, $-CHF_2$, $-CF_3$, $-OCH_3$, $-OCH_2F$, $-OCHF_2$ or $-OCF_3$, 1,4-cyclohexylene, 1,4-cyclohexenylene or 1,4-cyclohexadienylene, in which $-CH_2-$ may be replaced once or twice, independently of one another, by -O- or -S- in such a way that heteroatoms are not directly adjacent, and which may be monosubstituted or polysubstituted by halogen, or is 1,3-cyclobutylene or bicyclo[2.2.2]octane,

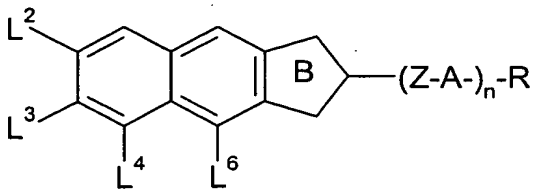
R is hydrogen, an alkyl, alkoxy, alkenyl or alkynyl radical having from 1 to 15 or 2 to 15 carbon atoms respectively which is unsubstituted, monosubstituted by $-CF_3$ or at least monosubstituted by halogen, where, in addition, one or more CH_2 groups in these radicals may each, independently of one another, be replaced by -O-, -S-, -CO-, -COO-, -OCO- or -OCO-O- in such a way that heteroatoms are not directly adjacent, halogen, -CN, -SCN, -NCS, $-SF_5$, $-CF_3$, $-OCF_3$, $-OCHF_2$ or $-OCH_2F$,

n is 0, 1, 2 or 3, and

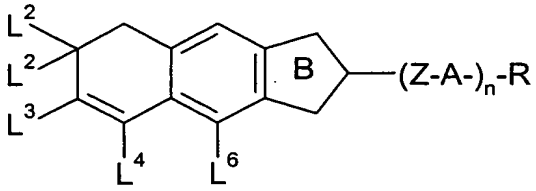
L^1 - L^8 are each, independently of one another, hydrogen, an alkyl, alkoxy, alkenyl or alkynyl radical having from 1 to 15 or 2 to 15

carbon atoms respectively which is unsubstituted or at least mono-substituted by halogen, where, in addition, one or more CH_2 groups in these radicals may each, independently of one another, be replaced by -O-, -S-, -CO-, -COO-, -OCO- or -OCO-O- in such a way that heteroatoms are not directly adjacent, halogen, -CN, -SCN, -NCS, $-SF_5$, $-CF_3$, $-OCF_3$, $-OCHF_2$, $-OCH_2F$ or $-(Z\text{-}A\text{-})_n\text{-}R$.

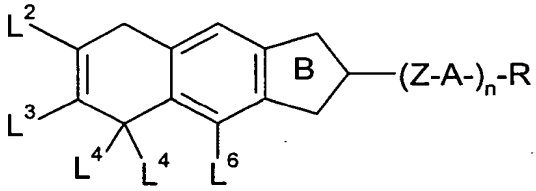
2. Cyclopenta[b]naphthalene derivatives according to Claim 1 selected from the general formulae (II) to (VI)



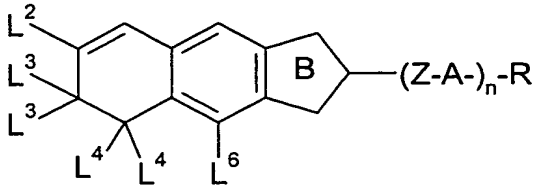
(II)



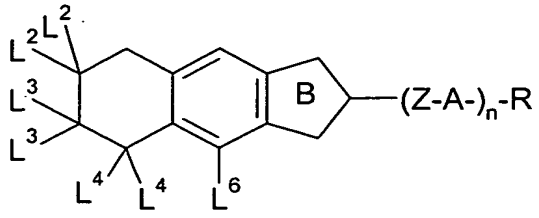
(III)



(IV)

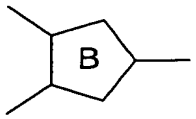


(V)

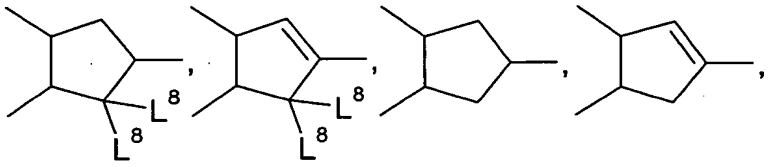


(VI)

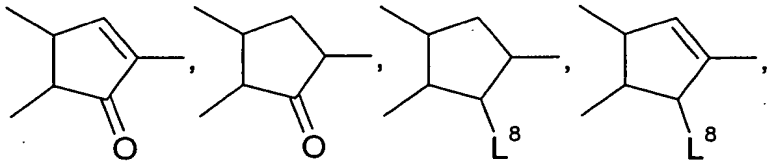
in which:



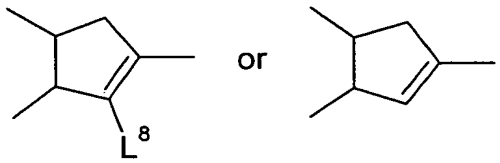
is



a **b** **c** **d**



e **f** **g** **h**



i **j**

Z is in each case, independently of one another, a single bond, a double bond, -CF_2O-, -OCF_2-, -CH_2CH_2-, -CF_2CF_2-, -C(O)O-, -OC(O)-, -CH_2O-, -OCH_2-, -CF=CH-, -CH=CF-, -CF=CF-, -CH=CH- or -C≡C-,

A is in each case, independently of one another, 1,4-phenylene, in which =CH- may be replaced once or twice by =N-, and which may be monosubstituted to tetrasubstituted, independently of one another, by halogen (-F, -Cl, -Br, -I), -CN, $-CH_3$, $-CH_2F$, $-CHF_2$, $-CF_3$, $-OCH_3$, $-OCH_2F$, $-OCHF_2$ or $-OCF_3$, 1,4-cyclohexylene, 1,4-cyclohexenylene or 1,4-cyclohexadienylene, in which $-CH_2-$ may be replaced once or twice, independently of one another, by -O- or -S- in such a way that heteroatoms are not directly adjacent, and which may be monosubstituted or polysubstituted by halogen, or is 1,3-cyclobutylene or bicyclo[2.2.2]octane,

R is hydrogen, an alkyl, alkoxy, alkenyl or alkynyl radical having from 1 to 15 or 2 to 15 carbon atoms respectively which is unsubstituted, monosubstituted by $-CF_3$ or at least monosubstituted by halogen, where, in addition, one or more CH_2 groups in these radicals may each, independently of one another, be replaced by -O-, -S-, -CO-, -COO-, -OCO- or -OCO-O- in such a way that heteroatoms are not directly adjacent, halogen, -CN, -SCN, -NCS, $-SF_5$, $-CF_3$, $-OCF_3$, $-OCHF_2$ or $-OCH_2F$,

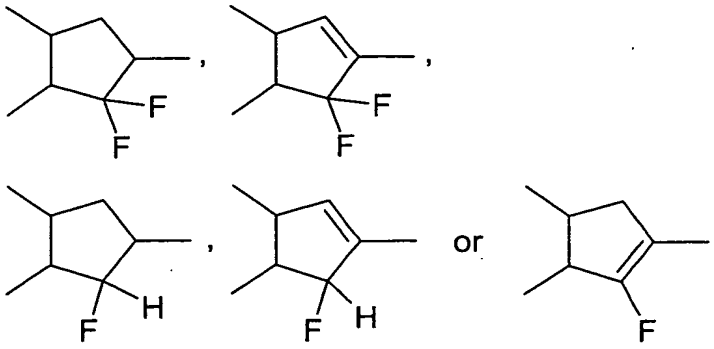
L^2, L^3 and L^8 are each, independently of one another, hydrogen, an alkyl, alkoxy, alkenyl or alkynyl radical having from 1 to 15 or 2 to 15 carbon atoms respectively which is unsubstituted or at least monosubstituted by halogen, where, in addition, one or more CH_2 groups in these radicals may each, independently of one another, be replaced by -O-, -S-, -CO-, -COO-, -OCO- or -OCO-O- in such a way that heteroatoms are not directly adjacent, halogen, -CN, -SCN, -NCS, $-SF_5$, $-CF_3$, $-OCF_3$, $-OCHF_2$, $-OCH_2F$ or $-(Z\text{-}A\text{-})_n\text{-}R$,

L^4 and L^6 are each, independently of one another, hydrogen, an alkyl, alkoxy, alkenyl or alkynyl radical having from 1 to 15 or 2 to 15 carbon atoms respectively which is at least monosubstituted by halogen, where, in addition, one or more CH_2 groups in these radicals may each, independently of one another, be replaced by -O-, -S-, -CO-, -COO-, -OCO- or -OCO-O- in such a way that heteroatoms are not directly adjacent, halogen, -CN, $-SF_5$, -SCN, -NCS,

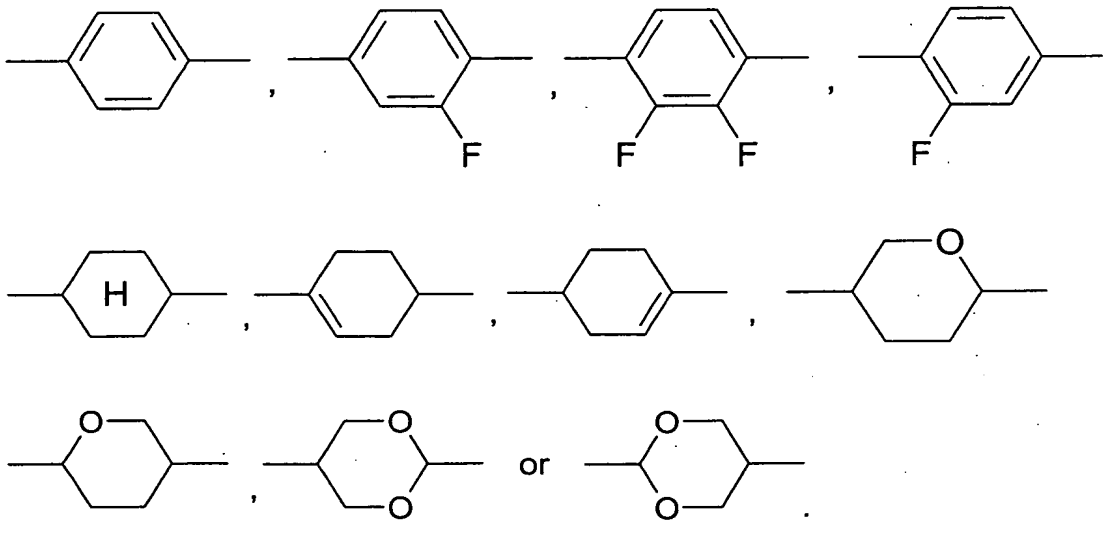
$-CF_3$, $-OCF_3$, $-OCHF_2$ or $-OCH_2F$, preferably with the proviso that L^4 and L^6 cannot simultaneously be hydrogen, and

n is 0, 1, 2 or 3.

3. Cyclopenta[b]naphthalene derivatives according to Claim 2, characterised in that B is



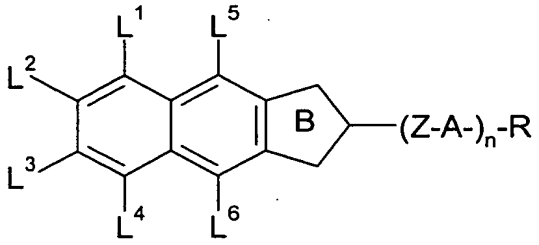
4. Cyclopenta[b]naphthalene derivatives according to Claim 2 or 3, characterised in that A is



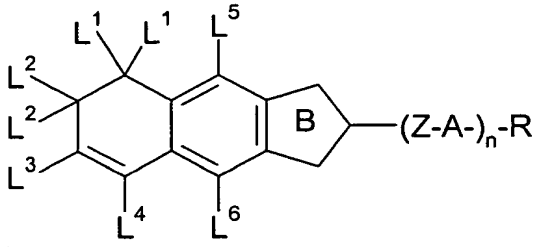
5. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 2 to 4, characterised in that L^2 and L^3, independently of one another, are hydrogen, an alkoxy radical having from 1 to 7 carbon atoms, fluorine or chlorine.

6. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 2 to 5, characterised in that L^4 and L^6, independently of one another, are $-CF_3$, fluorine or chlorine.

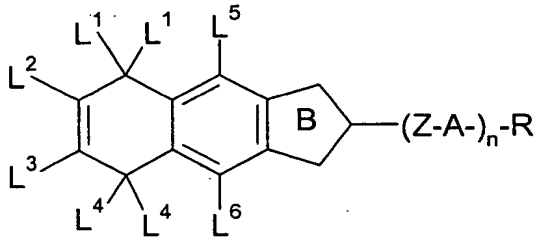
7. Cyclopenta[b]naphthalene derivatives according to Claim 1, selected from the general formulae (VII) to (XI)



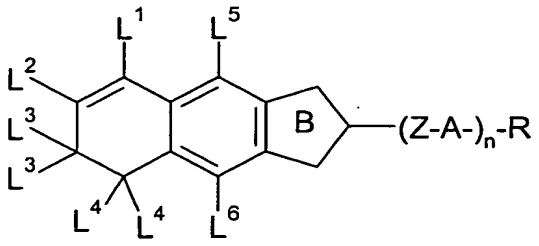
(VII)



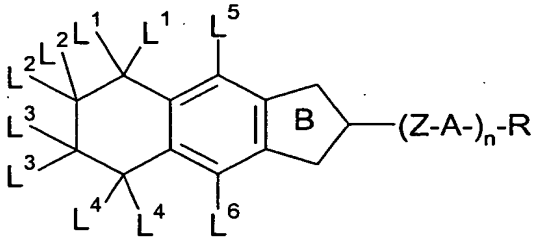
(VIII)



(IX)

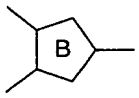


(X)



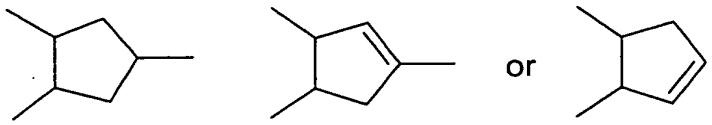
(XI)

in which Z, A, R, n, L^1 to L^8 and

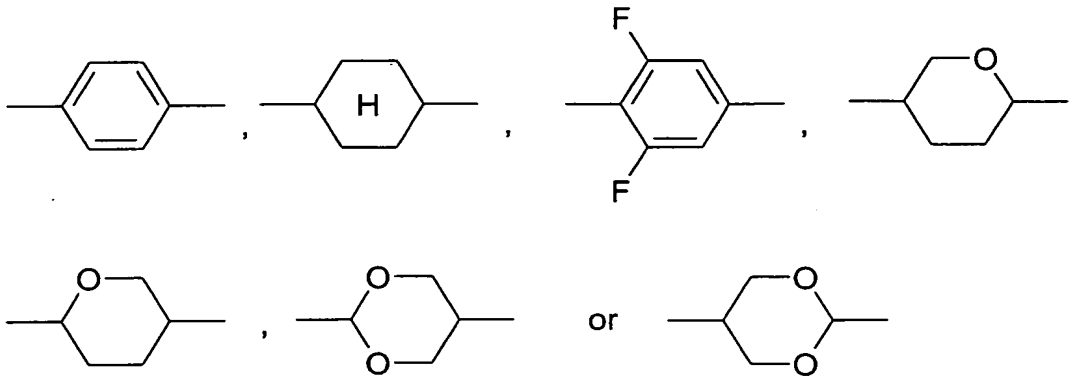


are as defined in Claim 1.

8. Cyclopenta[b]naphthalene derivatives according to Claim 7, characterised in that B is



9. Cyclopenta[b]naphthalene derivatives according to Claim 7 or 8, characterised in that A is



10. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 7 to 9, characterised in that L^2 and L^3, independently of one another, are identical or different and are hydrogen, halogen, -CN, -SCN, -NCS, $-SF_5$, $-CF_3$, $-CHF_2$, $-OCF_3$ or $-OCHF_2$.

11. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 7 to 10, characterised in that L^1 and L^4, independently of one another, are identical or different and are hydrogen or fluorine.

12. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 7 to 11, characterised in that L^5 and L^6 are hydrogen.

13. Cyclopenta[b]naphthalene derivatives according to at least one of Claims 7 and 12, characterised in that L^1, L^2, L^3 and L^4 are fluorine and L^5 and L^6 are hydrogen.

14. Cyclopenta[b]naphthalene derivatives according to at least one of the preceding claims, characterised in that Z is a single bond, $-CF_2O-$, $-OCF_2-$, $-CF_2CF_2-$, -CH=CH-, -CF=CH-, -CH=CF- or -CF=CF-.

15. Cyclopenta[b]naphthalene derivatives according to at least one of the preceding claims, characterised in that R is an alkyl radical, alkoxy radical or alkenyl radical having from 1 to 7 or 2 to 7 carbon atoms respectively.

16. Use of cyclopenta[b]naphthalene derivatives according to at least one of the preceding claims in liquid-crystalline media.

17. Liquid-crystalline medium comprising at least two liquid-crystalline compounds, characterised in that it comprises at least one cyclopenta[b]naphthalene derivative according to at least one of Claims 1 to 15.

18. Electro-optical display element containing a liquid-crystalline medium according to Claim 17.

19. Mesogenic medium, characterised in that it comprises at least one cyclopenta[b]naphthalene derivative according to at least one of Claims 7 to 15.

20. Electro-optical light-control element which contains an electrode arrangement, at least one element for polarisation of the light and a mesogenic control medium, where the light-control element is operated at a temperature at which the mesogenic control medium in the unaddressed state is in the isotropic phase, characterised in that the mesogenic control medium comprises at least one cyclopenta[b]naphthalene derivative according to at least one of Claims 7 to 15.